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A NEW DEPARTURE IN THE TEACHING OF ZOOLOGY.

Introduction to Zoology: a Guide to the Study of Animals, for the use of Secondary Schools. By C. B. Davenport, Ph.D., and Gertrude C. Davenport, B.S. Pp. xii + 412. (New York: The Macmillan Co. London: Macmillan and Co., Ltd., 1900.)

THE senior author of this book is well known in zoological circles for his two-volume work on "Experimental Morphology"—one of the most novel and ambitious of modern text-books; and his wife, whose aid he acknowledged in its preface, now appears as joint author of the present equally ambitious production, which has for its object nothing short of a revolution of the methods of zoological teaching in vogue in the secondary schools of the United States. The key to the plan of the work and nature of its contents lies in the prefatory pronouncement that the "vast majority of secondary students are not to be zoologists, but rather men of affairs," and that "what the ordinary citizen needs" zoologically is (not a course in comparative anatomy but) "an acquaintance with the commonest animals"—a knowledge of "where else over the world the common animals of his State are to be found, and of how animals affect man," and that to know these matters is for him "more important than to know the location of the pedal ganglion of the snail." There can be little doubt that in this resolve the authors are in agreement with a large section of active teachers, but it must not be forgotten that the didactic system of laboratory instruction in vogue, against which they are in the long run entering a protest, has in its development become modified beyond the conceptions and intentions of its founders, and that as originally planned it did not ignore non-anatomical considerations to the extent their attitude implies. In their forcible recognition of the later tendency towards so doing, however, and their bold attempt to overcome it, they have performed a useful task, but experience can alone decide upon the wisdom of the remedy they propose.

Their book is of 336 pages, excluding appendices, and is divided into twenty-one chapters. The first four chapters deal with the Insecta, and then follow one each devoted respectively to the Myriapoda and Spiders, two each to Crustacea, Worms and Molluscs, one each to the Echinodermata, Cœlenterata and the Protozoa, and then a series on the Vertebrates taken in ascending order, the whole closing with a novel chapter on the frog's egg as a study in development. The plan adopted in each chapter is much as follows:—Opening with a concise statement of the systematic position and relationships of an order or other great group of animals conveniently selected (with a definition of its name usually in a foot-note), there follows a very brief description of the habitus, and if so be the food and other special topics of interest, of one or more of its familiar species. There is then given a short descriptive account of its more familiar allies, and it may be of its development; and the whole chapter is brought to a close by an appendix, in the form of a key to the families of the order to which the type chosen belongs, or to the orders of the class or other great divisions of the group under consideration, while in places an accompanying key to the identification of members of allied subfamilies may be added or incorporated. The plainest and most concise terms are adopted, and there is a tolerably free use of illustration, preference being given to photographs of entire animals, often with their natural surroundings, in many cases with marked success; and it cannot be denied that the authors have been desperately earnest in the task of selection and compilation. The body of the work is followed by three main appendices, of which the second is a bibliographic list embodying a none too fortunate selection of books of reference, the third a synopsis of the "animal kingdom," and the first an outline of a course of laboratory work upon the type-organisms selected as titular for the main chapters. Novelty here is as great as with the rest of the book, for in the "Exercises" prescribed, after each type-organism has been referred to its habitat, with brief directions for its capture and preservation in the living state where necessary or desirable, there follow instructions for drawing, and series of questions, framed with a view of compelling the observer to determine details for himself, and not of pointing out the precise nature and limits of the observation he is expected to make, as is customary with most laboratory treatises current. "Hints for observations on the living animal" usually follow, as do "Topics for further study." This very novel scheme is the outcome of experience gained while aiding in the conduct of the zoological affairs of the Harvard University, and as here delimited it is prescribed "for use in schools that can give to the subject five periods per week for half a year," at discretion and with modification determinable by local needs. The book thus embraces a very ambitious programme, and we question if the most hopeful aspect of the undertaking is not simply the better encouragement of field-work and of observation of nature in the open, in respect to which our existing methods do perhaps stand in need of reform.

It appears to us, however, that too much has been attempted within the limits of the book, that there is danger in its too frequent brevity of statement, and that it stands in need of a greater uniformity of treatment. What, for example, is to be gained by merely referring to the Tunicata as "Chordata which are either attached or form colonies, or both" (which is an erroneous statement), and as a group of Invertebrates which "lie nearest to the stem from which the Vertebrates arose," when whole paragraphs are given to far less generally important assemblages of forms? What also the use of defining the Stomatopoda as including "only Squilla," and then Cumacea, Isopoda and Amphipoda as embracing a number of forms? The inclusion of the Sponges in the Cœlenterata; the old-fashioned classification of birds, with the Ratitæ referred to the order "Cursores"; the inclusion of the Bryozoa on one page among the Gephyrea and Leeches ("Annelida"), and on another among the "Scolecida"! can only be cited as examples of classificatory treatment sorely in need of revision; while among

definitions given we note a frequent lack of accuracy and precision, as, for example, with that of the Ophidia as having their "eyelids absent." The senior author's previous work explains the introduction of experimental observations of the antenniform-ophthalmite order, and brief note is taken of "variation" and abnormality. The social life and "language" of ants, protective resemblance and mimicry among the Lepidoptera, the habits of the spiders, and many other similarly fascinating topics receive in due course passing consideration. The reader will put down the book feeling the better for its perusal and with a desire to know more, while its "keys" to the identification of the common forms of life, oft overlooked because always present, but withal foremost in their claims on our attention, will prove useful and encouraging. We are doubtful, however, whether the authors would not have done better to have attempted less and that more uniformly, and whether they are justified in their refrain that in matters of elementary scientific education the mere "needs" of the ordinary citizen are to be alone gratified. We are by no means convinced that this argument is sound. Their method would seem likely to discount the teacher's important function of deciding what is to be left untaught—a matter of the utmost urgency in elementary scientific work. We shall watch with interest the development of their scheme.

COLOUR PHOTOGRAPHY.

A Handbook of Photography in Colours. By Thomas Bolas, Alexander A. K. Tallent and Edgar Senior. Pp. viii + 343. (London: Marion and Co., 1900.)

THE preface or introduction is written by the publishers, and is immediately followed by an index. Then follow three "sections." (1) 85 pages, by Mr. Bolas, on the "Historical Development of Heliochromy. General Survey of Processes. Direct Heliochromes on Silver Chloride." (2) 205 pages, by Mr. Tallent, on "Three-colour Photography." (3) 27 pages, by Mr. Senior, on "Lippmann's Process of Interference Heliochromy." Each section is quite distinct from the others, except that they are bound into one volume and indexed together; there is therefore much repetition. For example, Maxwell's colour-sensation curves and Abney's revised curves are each given twice (the two renderings, by the way, are not identical), and Lippmann's formula for his emulsion is given at p. 55 and also at p. 332. Careful editing would have avoided such waste of space. Some of the diagrams are drawn with exceedingly thick lines, and are provided with very large heavy lettering, while others incline rather in the opposite direction. Some of the spectra as drawn for showing absorption, sensitiveness and so on, have the red to the left-, and others the red to the right-hand side; some are normal, and others are as produced by prisms. It may be said that these are quoted from various sources; but in a volume in which it is thought necessary to explain with a large diagram the refraction of light on passing from air into water, surely a little explanation of these differences is desirable. At p. 180, a spectrum which is normal is described as "prismatic." The volume appears not to have been edited at all, therefore the only way to do justice to the authors is to regard it as three distinct books.

Mr. Bolas gives an excellent summary of the whole subject, both historical and practical. As a careful compiler should do, he has erred, if it be an error, in including too much rather than too little. Carey Lea's highly coloured partial reduction products of the halogen salts of silver might have been passed by, by some writers, as well as other references to conjectures. Zenker's work and Wiener's investigations are described intelligibly, although concisely; indeed, the author has evidently spared no pains to give every one his due, and to use to the best advantage the small space at his disposal.

Mr. Tallent begins his section with several pages on the properties of light and the construction of ordinary spectroscopes—matter which, we think, might well have been omitted in order to make room for the treatment of subjects for which the reader is often referred to other books or articles. The peculiar firework-like diagram at p. 112, given to illustrate dispersion, is more likely to mislead than assist the student; and some of the other diagrams might have been made more clear, in spite of the extraordinary boldness of the drawing and lettering. Mr. Tallent has gathered together a great deal of information about three-colour work, which he presents in the form of notes rather than as a treatise. It is doubtless advantageous in some cases to supply the raw material only, but the possession of bricks and mortar does not enable every one to build himself a house. If the very popular style of description sometimes adopted were given up in favour of more technical details, and if the practical applications of the various principles were more closely associated with the enunciation of the principles themselves, we think that the book would be more useful to the large majority of those who will read it. But we must be grateful to Mr. Tallent for having made a beginning in the getting together of the hitherto widely scattered items of the subject. His work must be of considerable assistance to any one following him, and we hope that later on he himself may be able to give us a treatise founded on these notes.

Mr. Senior treats only of Lippmann's interference process, and he writes on this with authority, for he has given the matter much practical attention, and has produced some of the best examples that have been seen. He gives his formulæ and methods apparently without any reserve, as well as the published formulæ of other notable workers. He precedes the practical details with a few pages on the optical principles involved, setting forth clearly the character of "stationary waves." We think that most people reading p. 323 would consider it as showing that the colours reflected from a Lippmann photograph are complementary to those of the objects photographed, but it is quite obvious that Mr. Senior does not intend to convey this impression.

The publishers, in their preface, state that thirty-one years ago they published the pioneer work on photography in colours (by Ducos du Hauron), and they feel satisfaction now in following up the line they "opened up over a quarter of a century ago." All who are interested in the subject will feel thankful to Messrs. Marion and Co. for having done so. C. J.